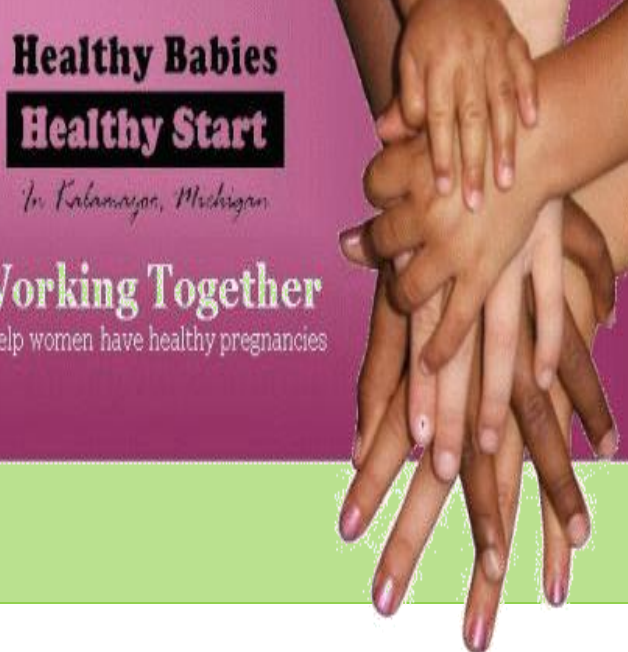# USING GIS TO EXAMINE THE RELATIONSHIP OF MATERNAL RACE AND NEIGHBORHOOD RACIAL SEGREGATION WITH BIRTH OUTCOMES

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Healthy Babies Healthy Start
In Kalamazoo, Michigan
Working Together
to help mothers have healthy pregnancies

PURPOSE

Kalamazoo County reflects national and statewide birth disparity trends, with infant mortality rates 2.5 to 3 times higher among blacks compared to whites. Racial health disparities have been shown to vary widely across communities throughout the nation, and are thought to be closely linked to a community's racial segregation.[2] Geographic Information Systems (GIS) is useful in both illustrating and analyzing geographic distributions of social phenomenon, such as racial segregation and birth outcomes.[3] This study utilized GIS to define racially segregated neighborhoods in Kalamazoo County and examine the association of race and racial segregation with birth outcomes at the individual maternal level as well as at the neighborhood level.

The purpose of this study was:
To identify racially segregated Kalamazoo neighborhoods using GIS
To examine the association of race and racial segregation with birth outcomes
. at the individual maternal level
. at the neighborhood level

METHODS

Design: This was a secondary data analysis of Kalamazoo County 2008 birth certificate database. Access and permission to use the data was provided by the Michigan Department of Community Health, Division for Vital Records and Health Data Development to the principal investigator.

Sample: The population of Kalamazoo County live births 2008, stratified by maternal race (Black and White).

• N=2,992

Data Collection:

• *Birth Records:* Variables in the birth dataset used in this analysis included maternal address, demographics (age, race, education, marital status, Medicaid paid birth), maternal health indicators (obesity, prenatal weight gain, diabetes, sexually transmitted infection (STI)), health behaviors (smoking, alcohol consumption) healthcare access/utilization (1st trimester prenatal care, WIC enrollment) and birth outcomes (infant death within 1st year, very low birthweight (VLBW), low birthweight (LBW) and prematurity (<37 weeks gestation).

• *Shapefile:* The Kalamazoo County shapefile containing Y2000 census tract boundaries was downloaded from the Michigan Geographic Data Library (MiGDL).

• *Census Tract Characteristics:* Census tract characteristics were downloaded from the Michigan 2010 Census Planning website (www.cridata.org.htc) and included population, housing units, vacant units, owner-occupied units, percent in racial categories and percent in age categories.

Analysis: . Data analysis was conducted using SPSS 18 and GIS analysis was conducted using ArcGIS 10.0

• Birth records were geo-coded using maternal address, were linked to census tract through a spatial join within ArcGIS and the resulting attribute table was then exported for statistical analysis.

• Pearson chi square and correlation were conducted for the bivariate analysis of race (Black/White) and the remaining covariates. Logistic regression modeling was then completed at the individual level and linear regression at the tract level for each of the four birth outcome variables (death, VLBW, LBW and prematurity). Statistical significance was two-tailed at the .05 level.

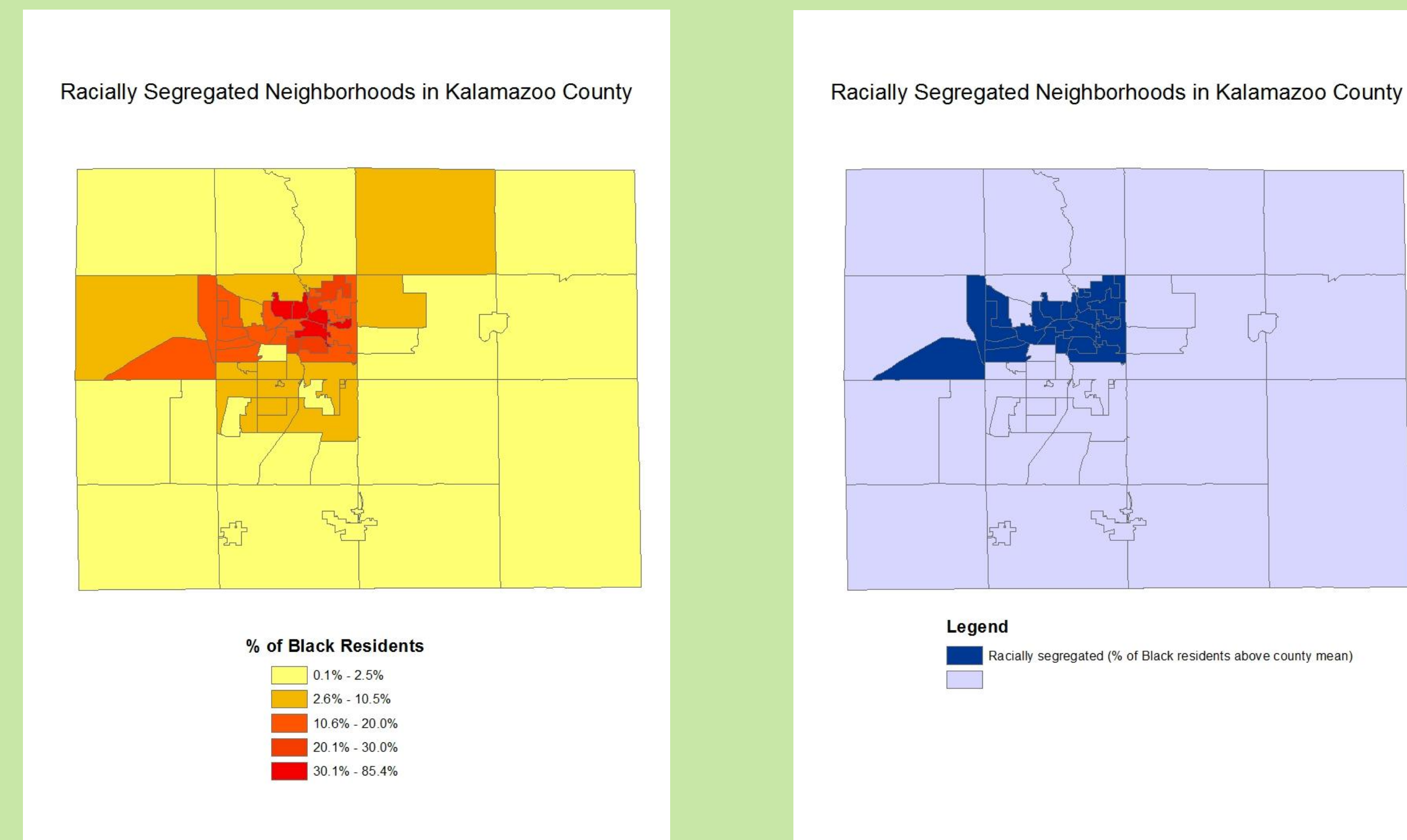## NATIONAL PICTURE OF RACIAL SEGREGATION
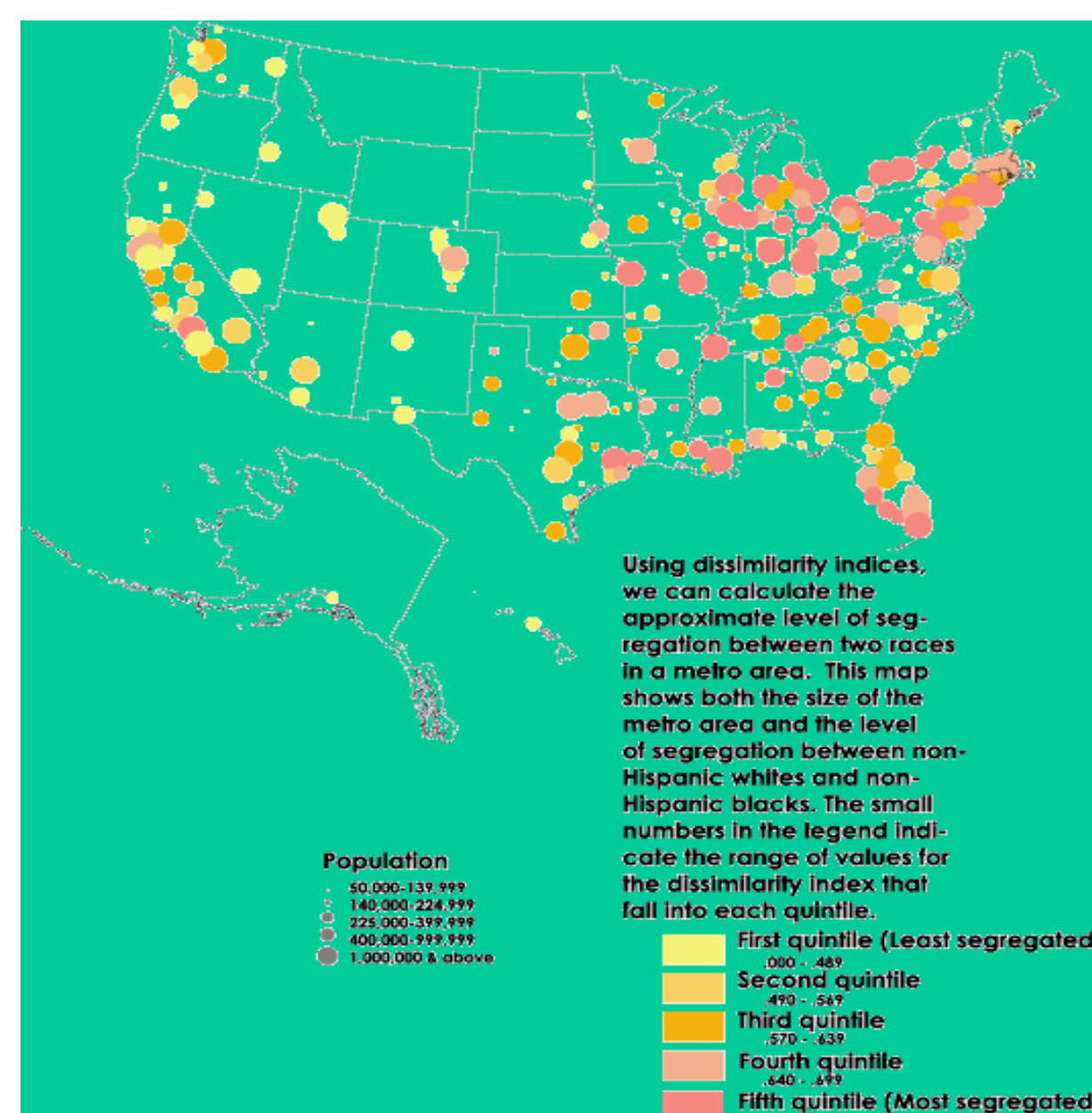
Dissimilarity Index

• The most commonly used measure of segregation
• Compares the two groups' relative distribution across a geographic area
• Range: 0 = Complete integration to 100 = Complete segregation

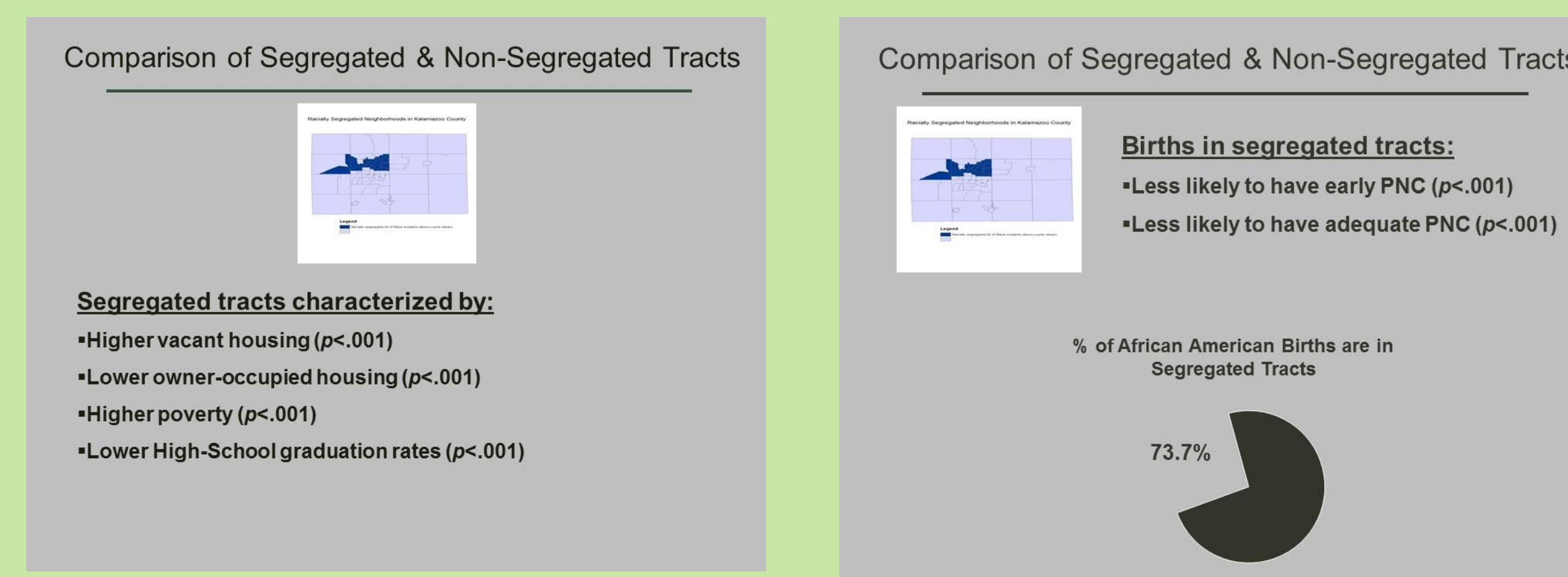• Kalamazoo/Battle Creek Metro Area:
  • Caucasion & African American

Kalamazoo = 59.4 Dissimilarity Index
-Ranked 152 out of 318 metro areas

*CensusScope: www.censusscope.org/segregation.html

RESULTS: Distribution of Black Residents Across Kalamazoo County Census Tracts

Racially Segregated Neighborhoods in Kalamazoo County

% of Black Residents
- 0.1% - 2.5%
- 2.6% - 10.5%
- 10.6% - 20.0%
- 20.1% - 30.0%
- 30.1% - 85.4%

Racially Segregated Neighborhoods in Kalamazoo County

Legend
- Racially segregated (% of Black residents above county mean)

RESULTS: Comparison of Disproportionate Black Tracts with Disproportionate White Tracts

Comparison of Segregated & Non-Segregated Tracts

Segregated tracts characterized by:
•Higher vacant housing (p<.001)
•Lower owner-occupied housing (p<.001)
•Higher poverty (p<.001)
•Lower High-School graduation rates (p<.001)

Comparison of Segregated & Non-Segregated Tracts

Births in segregated tracts:
•Less likely to have early PNC (p<.001)
•Less likely to have adequate PNC (p<.001)

% of African American Births are in Segregated Tracts

73.7%

RESULTS: Mapping Birth Outcomes

Racial Segregation and Distribution of Black Births

Legend
- White births
- Black births

Legend
- Racially segregated

Above the County Mean on Poor Birth Outcomes

(Infant death, VLBW, LBW, prematurity rates)

Racial Segregation
- Racially segregated (% of Black residents above county mean)

Above the county mean on...
- No bad outcomes
- One bad outcome
- Two bad outcomes
- Three bad outcomes
- Four bad outcomes

RESULTS: Multivariate

Neighborhood Risk Factors for Prematurity – Linear Regression (N=60 census tracts)

Prematurity rate:	Unstand. Coeff. B	Stand. Coeff. Beta	Sig.	95.0% Confidence Interval for B Lower Bound	95.0% Confidence Interval for B Upper Bound
Pct Vacant Housing Units	-.104	-.065	.721	-.883	.475
Pct Not High School Grad	.205	.373	.079	-.025	.436
Pct Below Poverty	-.076	-.194	.248	-.206	.054
Pct African American	.039	.132	.567	-.098	.177

Maternal Risk Factors for Prematurity – Logistic Regression (N=2,992 women)

Whether Premature or not	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	95% C.I.for EXP(B) Upper
Medicaid insurance	.126	1.293	.930	1.798
Unmarried	.471	.886	.637	1.232
Maternal HS graduation	.726	1.066	.744	1.525
Adolescent	.785	1.057	.708	1.577
Maternal obesity	.754	.959	.738	1.247
Inadeq. Prenatal weight gain	.510	.905	.672	1.218
Prenatal STI	.117	1.294	.937	1.786
Initiated care in 1st trimester	.174	.824	.623	1.090
Prenatal smoking	.009	1.481	1.104	1.986
Maternal race is Black	.000	1.823	1.330	2.499
NEIGHBORHOOD segregated	.128	.808	.614	1.063

CONCLUSIONS

Key Findings
Wide variation in racial composition across neighborhoods. Census tracts within Kalamazoo county ranged from 0.1% to 85.4% Black residents, with an average of 10.5% Black residents.
  Nearly three-quarters of Black births were to women residing in disproportionately Black tracts
Segregated neighborhoods that are disproportionately Black characterized by decay and disadvantage.
  Significantly higher housing vacancies, renter-occupied housing and poverty rates.
  Significantly lower High-School graduation rates, early initiation of prenatal care, adequate level of prenatal care.
Neighborhood racial segregation was not directly associated with prematurity.
  At the neighborhood level, percent of Black residents was not significantly associated with the percent of premature births, once neighborhood characteristics were taken into account
  At the individual maternal level, whether a woman lived in a segregated neighborhood (with disproportionate Black residents) was unrelated to whether or not she delivered prematurely
Maternal race, however, at the individual level was a strong predictor of premature delivery
  Being of Black race increased the odds of a premature delivery nearly two-fold, even after other key risk factors were taken into account

Study Limitations
May not have captured key neighborhood characteristics (safety, access to food, environmental hazards)
Census tract divisions may not align with important neighborhood boundaries
May not have captured key individual characteristics that may either pose additional risk or that may mediate the socio-cultural effect of neighborhood

Conclusions
Race matters. But it appears to matter more at the individual than the neighborhood level, at least as measured by racial segregation and density.

ACKNOWLEDGEMENTS

REFERENCES

[1]Michigan Department of Community Health, Division for Vital Records & Health Data Development, Live Birth File & Death File

[2]Kramer M.R., C.R. Hogue. (2008) Place Matters: Variation in the Black/White Very Preterm Birth Rate Across U.S. Metropolitatn Areas, 2002-2004. *Public Health Reports.* Vol.123, pp 576.

[3]Steinberg, S.J., S.L. Steinberg. (2006). Geographic Information Systems for the Social Sciences: Investigating Space and Place. Sage Publications: Thousand Oaks, CA.